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EOT-Polar: Tide model of the polar oceans from multi-mission satellite altimetry

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Summary: Tides in the polar oceans are complicated to accurately determine due to limited coverage from satellite altimetry or in-situ observations and poorly resolved bathymetry data in the region. Additional complexities arise from the influence of sea ice on both the tides and the retrieval of sea level measurements from altimetry. Although several altimeters reach high latitudes, their orbits are sun-synchronous and do not allow for the estimation of the full tidal signal. The orbiting of Cryosat-2 provides valuable insight into the ocean tides in the polar regions, thanks to its ~28-day sub cycle. This data availability has resulted in advances in the accuracy of altimetry-derived models and a deeper understanding of the spatial variability of tides in the Arctic (Andersen et al., 2023). This poster presents the results of a concerted effort based on the expansion of the EOT model into the polar oceans. The so-called EOT-Polar continues the traditional multi-mission of the global model but, for the first time, incorporates the newly reprocessed Cryosat-2.

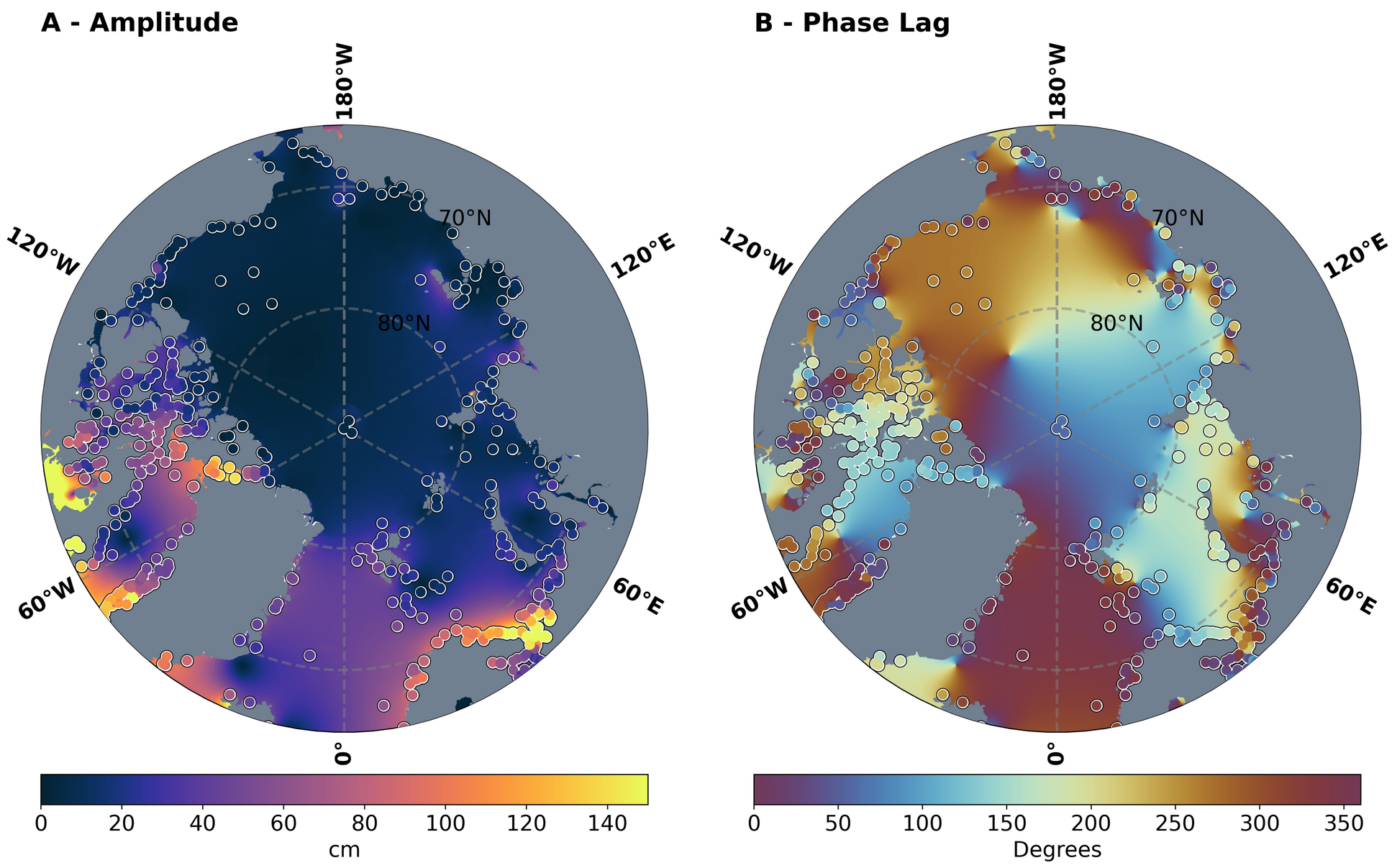

Figure. Amplitude (cm) and phase lag (degrees) of EOT-Polar v0.3 in the Arctic Ocean. Circles are in-situ measurements from ArcTiCA (Hart-Davis et al., 2024).

Processing Strategy

- The Empirical Ocean Tide (EOT) model is a series of global tide models developed at DGFI-TUM based on multi-mission satellite altimetry data (Hart-Davis et al., 2021).
- Traditionally, global EOT models did not make direct estimations of ocean tides in the polar regions and relied on the reference model in these regions.
- Using multi-mission satellite altimetry, particularly the Cryosat-2 data, the model has been extended to include the polar regions.
- Unlike previous EOT versions, this current iteration of EOT-Polar does not rely on a reference model and is, therefore, a full estimation as opposed to a residual estimation.
- The model includes a new gridding strategy that is designed to take advantage of the orbit of Cryosat-2 and the favourable pseudo-repeat of the mission in the higher latitudes.

EOT-Polar v0.3

- EOT-Polar currently produces estimates for the eight major constituents on a 1/16° spatial grid.
- For the M_2 constituent, it shows median amplitude and phase lag errors of 2.1 cm and 1 degree, respectively. This aligns with the other global models in the region like FES2022 and DTU23 (Torres et al., 2024).
- The sea level data used incorporates a sea ice flag based on NSIDC daily sea ice concentrations (https://nsidc.org/data/g02135/versions/3), which reduces the contamination of sea ice on the resultant estimations. Ongoing work is planned to improve the detection and flagging of sea ice (see Müller et al., 2017).
- The final version of EOT-Polar will be released by early 2025, for more information please contact: **michael.hart-davis@tum.de**

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